In valvular disease, as in other instances of disease of the heart, advance in knowledge is demonstrating how the arrow in the side can be kept from being fatal.

THREE SUCCESSFUL CASES OF CEREBRAL SURGERY.

INCLUDING (1) THE REMOVAL OF A LARGE INTRACRANIAL FIBROMA; (2) EXSECTION OF DAMAGED BRAIN TISSUE; AND (3) EXSECTION OF THE CEREBRAL CENTRE FOR THE LEFT HAND;

WITH REMARKS ON THE GENERAL TECHNIQUE OF SUCH OPERATIONS.[1]

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(Concluded from page 357.)

Case III. *Epilepsy of uncertain origin; attacks beginning in left hand; excision of cerebral centre for left wrist and hand; recovery in eight days; epilepsy improving to date.*—W. B., of Maryland, aged twenty; American; clerk in a country store. His best and present weight is one hundred and thirty pounds; five feet five inches in height. The patient is a hearty young man, having had all the diseases of childhood except scarlet fever. At the age of three years he had spasms for six hours from indigestion. He had no subsequent attacks.

At the age of thirteen, he rose one morning at four o'clock to make the fire, and after doing so fell asleep in a chair, from which he fell, and he thinks he struck his head on the stove. He was unable to fix the location of the blow, as there was no cut or bruise on the head. On waking up he found himself on the floor dazed and suffering with headache, which continued all day, but was not sufficient to keep him in bed. His history is quite imperfect in detail. Ever since this accident (?) he has had epileptic attacks, always preceded by dizziness. Stooping often brings one on, he and his family say (though he could never accomplish this before me). He has never had a hurt in consequence of these attacks. Sometimes they occur in the night. He eats and sleeps well. His friends state that the attacks begin with a fixed or a wild look from the eyes, and when engaged in any action, such as tying a bundle with twine, he would continue the action for an unreasonable time, till he would come out of the attack and resume his work as usual. His head sometimes turned to one side and sometimes to the other before any other part of the body became affected, then the arms would begin to jerk, then the convulsion would become general. The fits would last about two or three minutes, and would be characterized by very marked convulsive movements.

Present condition, April 23, 1888: *Head.* When the head was shaved two small scars were seen, one from a recent blow and one unaccounted for; neither of them seemed important. On the right temple was a distinct furrow, which could be traced over the temporal muscle into the temporal fossa. It began one-quarter of an inch to the right of the middle line, and seven-eighths of an inch in front of the bi-auricular line, terminating below one and one-quarter inches in front of the bi-auricular line and one and three-quarters inches above the zygoma, and one and one-half inches behind the external angular process. At first this irregularity was thought to be the coronal suture, but it was so regular on the edges and so sharply defined that it was thought to be a furrow, and the question was, Might it not be a fracture? No such furrow existed on the left side, where the coronal suture was detected with great certainty. On the right side, the coronal suture, unless it was this furrow, was very indistinct. The temporal artery lay posterior to the furrow.

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[1] Read before the American Surgical Association, September 18, 1888.

Dr. Charles A. Oliver makes the following report on his *ocular conditions:* "April 24, 1888. Direct vision for form, normal in each eye separately. Range and power of accommodation in each eye, proper for refractive error and age of patient. Visual fields normal in sequence, though both reduced to more than one-third the average areas, those of the right side being somewhat the smaller. No subnormal color-perception. Pupils normal in size and shape. Irides freely and equally mobile to light-stimulus, convergence, and accommodation. Very slight insufficiency of the interni. Characteristic changes in the eye-grounds usually seen in epileptic subjects with frequent seizures—*i. e.*, a low and chronic form of retinitis, associated with a dirty red-gray appearance of the optic nerve: this being the more marked on the right side.

"*Remarks.*—From this grouping of eye-symptoms, which, with the exception of the eye-grounds and their resultant visual fields, are normal, and hence negative in character, there can be but one legitimate conclusion: a similar condition of the layers of the cerebral cortex, the result of repeated convulsive seizures; the position of the greatest amount of change (indicative of probable situation of irritation focus) being indeterminable."

The friends of the patient insisted on something being done at once, as they desired to take him home. I stated that I would make an exploratory incision in the scalp, and if anything abnormal was found I would go further.

April 30, 1888. Operation.—An exploratory operation was done by making a horseshoe-shaped incision with the convexity looking backward, enclosing in its area the suspicious groove before alluded to. Just before the operation another very careful examination was made, and three facts noted of importance: First, the coronal suture could be more distinctly made out than was at first supposed, and it lay behind the furrow; second, the furrow bifurcated in such a way as to suggest a bloodvessel; third, at the lower part of the furrow pressure caused bulging corresponding to the furrow and again suggested a vein. In view, however, of the preparation for the operation and the urgent anxiety on the part of his friends, I deemed it best to make the exploratory incision. The most careful antiseptic precautions, as detailed in Case I., were used, without the spray. Ether was the anæsthetic used. No ergot or morphia was given, as I hardly deemed it probable that I should do more than make an incision of the scalp. On lifting the scalp from the skull nothing abnormal was found. The groove or furrow, so particularly described, was found to be a vein, but I never before felt a vein with such sharp, hard borders, and, until just before the operation, I was very doubtful as to what the furrow was. The patient made an uninterrupted recovery without any rise in temperature.

When he had recovered his family changed their minds, and advised that he remain here under my observation for treatment with drugs, or another operation should anything be found to indicate its being desirable. Accordingly I placed him under the constant care of two trained nurses, who reported to me the character of each fit in its minutest detail. Dr. Sprissler had already seen two attacks from the beginning, and the nurses reported three others which were completely observed. All five of the attacks were practically as follows: Each attack invariably began in the left arm and fingers. The thumb and fingers became rigid and extended, widely separated, the hand and arm in a right line and the elbow flexed; usually both legs were next attacked, the left usually preceded the right and was crossed in front of it; next the face became attacked, the mouth being drawn to the left. (In one attack the mouth was affected before the leg.) After this the convulsions became generalized; the fingers of both hands flexed; the pupils were first dilated and then contracted. These attacks lasted from one to ten minutes. The number of them was markedly increased immediately after the operation of April 30th. Not unusually he would have one or two a day, but they gradually diminished to their normal frequency. Finding, now, that the fits began, so far as was observed, in the left hand, I determined to excise the centre for the left hand and wrist.

Operation May 30, 1888. Present, Drs. William Thomson, J. H. Musser, F. X. Dercum, J. M. Taylor, J. K. Mitchell, Morris J. Lewis, W. J. Taylor. His head was prepared on the day previous with the usual precautions mentioned in Case I. One-eighth of a grain of morphia and a drachm of ergot were given half an hour before the operation. During the etherization he had a fit, as was the case at the former exploratory operation.

A curved incision, 3 x 3½ inches, was made with the convexity looking backward, the flap lying over the fissure of Rolando. This fissure had been first marked on the scalp by Hare's and Thane's methods; the results of both of which were practically identical. In order to indicate it upon the skull itself, two small incisions were made at the upper and lower end of the line, and with a bone gouge two little nicks were made in the skull through the openings. A one and one-half inch trephine was now applied, the centre pin one-eighth of an inch back of the fissure of Rolando, the lower margin of the trephine being about a quarter of an inch above the temporal ridge. The bone when removed was placed in a cup of bichloride solution (1:2000). This cup was placed in a large basin of hot water, which Dr. Musser was careful to keep at 105°-100°. The bone and dura both appeared normal; no bulging was observed, and the pulsation was regular. The dura was now partially incised and the brain exposed. The pia was very much infiltrated with serum, producing an œdematous layer much obscuring the brain tissue, especially the sulci over all this area. Two convolutions, running obliquely from above downward and forward, crossed the trephine opening entirely, while at the anterior border a third convolution, apparently in a similar direction, was partially uncovered. Large veins ran in the pia over the sulci. An attempt was made to determine which was the Rolandic fissure and which was the minor fissure by separating the convolutions and determining their depth, but both the sulci exposed were about an inch deep. This, therefore, gave no clew to the point desired. Depressing the brain exposed a further area under the edge of the bone but gave no information of moment. An application of the cyrtometer (disinfected) was then made to redetermine the position of the fissure of Rolando. This ran in the middle of the three convolutions before mentioned (Fig. 9). In order to determine the seat of the hand centre a faradic battery was then used. The ends of the wire were wrapped in borated cotton dipped in bichloride solution. Stimulating the two posterior convolutions gave no results, even when the current was perfectly perceptible to my hands and contracted my muscles. On touching, however, the anterior one of the three convolutions the hand instantly moved, the wrist (as observed by Morris J. Lewis) moving in extension in the midline and to the ulnar side at different touches, and the fingers being extended and separated. Above this centre were the shoulder and elbow centres, and below the face centre, as described further on.

FIG. 9.

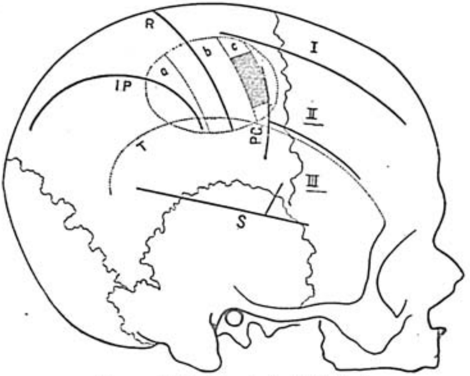

Diagram of skull. (Drawn by Dr. J. M. Taylor.)

S, Fissure of Sylvius. R, Fissure of Rolando. IP, Intraparietal sulcus. PC, Precentral sulcus. T, Temporal ridge. I, II, III, the first, second, and third frontal convolutions. The *dotted* line represents the opening in the skull; *a, b, c,* are the three convolutions first exposed in the trephine opening. The *shaded lines* represent the portion excised.

The opening in the skull was now enlarged, chiefly forward and downward, till it measured two and a half inches antero-posteriorly by two and a quarter inches vertically, so as to disclose this convolution (*c*) to a larger extent. From the point of application of the centre pin (an eighth of an inch behind the fissure of Rolando and one inch above the temporal ridge) the opening extended forward one and three-eighths inches, backward one and one-eighth inches, upward one inch, and downward one and a quarter inches. In enlarging the opening forward I invaded the territory covered by the flap of the exploratory operation a month before. Under this area the dura was noticeably more adherent to the bone than elsewhere.

The anterior border of this convolution (Fig. 9, *c*) was marked by a fissure nearly parallel with the other two. The portion of the convolution (*c*) containing the hand-centre, about one and a quarter inches long, as ascertained by the battery, was then incised vertically above and below with a knife, the lower incision being three-eighths of an inch above the temporal ridge. The sulci in front of and behind this convolution had been previously freely opened. The lower end of the portion to be taken away was then lifted and the loosened convolution was cut away from the underlying brain substance with a pair of scissors. While this was being done the hand was watched, but no movement was perceived. The wires of the battery were now again applied, while Dr. Lewis again observed. At the remaining part of the convolution at the upper margin of the excised portion, movements of the left elbow (flexion and extension) and shoulder, especially of the latter, which was raised and abducted, were noticed. Touching the part of this convolution remaining at the lower border of the excised portion, produced an upward movement of the whole left face, no one muscle being noticeable in isolated contraction. The platysma was not contracted nor was the angle of the mouth drawn downward. Touching the white matter at the bottom of the excision produced again the movements of the hand. It was deemed, therefore, certain that all the hand-centre had been removed. It was noticed that the convolution immediately behind the part excised was somewhat bruised in the efforts to open the sulci on that border.

Dr. Lewis now took a photograph of the exposed brain. Comparatively little trouble had been experienced from hemorrhage. An Esmarch bandage had been applied to the scalp, but it, probably, was not drawn tight enough, as a few of the vessels bled somewhat freely. These were caught with hemostatic forceps and the bandage was removed. It had been passed only twice around the head. In the brain itself the large vessels were necessarily disturbed to a considerable extent and bled quite freely. Cocaine (four per cent.) and hot water did good service, but for the larger vessels ligation answered best. This was done with Kocher catgut. The tying had to be extremely gentle, with even pulling of the two ends, else the vessels would give way. The dura mater was now replaced and sewed with fine chromic catgut, two bundles of horsehair having been placed underneath it. The final oozing was so slight that it was not deemed necessary to put a drainage tube under the dura. The disk of bone and some fifteen pieces removed by the rongeur forceps were now replaced on the dura. Two bundles of horsehair were placed between the bone and the scalp and also a small rubber drainage tube posteriorly. The scalp wound was then closed by fifteen chromic catgut sutures. An abundant dry dressing of corrosive sublimate, rubber dam, and a bandage completed the dressing. The operation had lasted about an hour and a quarter. When put to bed the condition of the patient was satisfactory. As soon as he recovered from the ether he was quite violent in his restlessness. Soon afterward he had an epileptic attack ushered in by staring eyes, then the left leg was crossed over in front of the right and the body became rigid. In about a minute the fit was over. No movement of the left hand or face occurred. Immediately after the operation the left hand was found to be paralyzed as to all movements both of fingers and wrist. The elbow was paretic, the shoulder and face perfectly unaffected.

At 6 P. M. the dressing was changed as it was saturated to the margin from moderate bleeding. Again at 3.30 A. M. May 31st, the wound was redressed for the same reason. The oozing at this dressing was much more serous and less bloody. At 12.30 A. M. May 31st he had another epileptic attack lasting about a minute precisely similar to the last one, except that he rolled over on his abdomen.

31st, 8 A. M. (first day after the operation). The patient has been perfectly conscious ever since he recovered from the ether. The only physical change noted was the paralysis of the left hand, which was unaltered. The pupils were unaffected. He slept some during the night, but, on the whole, the night was restless and disturbed. A catheter was used both last night and this morning. The urine was normal in quantity and quality. He complains of discomfort, but states that he has no pain of any moment. He was allowed nothing but ice during the night, but this morning, as he was moderately hungry, he was given some milk. Some rather violent retching followed the operation but it ceased later in the evening. The wound was redressed, as the dressing was slightly moistened with bloody serum, and the drainage tube removed. In the left hand each finger was recognized correctly, but the two points of the æsthesiometer were recognized as only one when so far separated as the entire length of the finger or the entire breadth of the hand. The right hand, however, is but little better than this, as the two points are recognized on the fingers as one at two-thirds the length of the fingers apart and about the same crosswise. His mental condition is such, however, that I do not think this test reliable, saving to show that the left hand, in a general way, is not so sensitive as the right.

June 2 (third day). The wound was redressed although the dressing was scarcely stained. Five out of the fifteen sutures were removed, as the wound was sealed throughout its entire length, saving where the drainage had been. All the horsehairs but six were removed; two of these going under the dura and four under the scalp only. An enema to-day evacuated the bowels satisfactorily. His urine is evacuated only by catheter twice a day. The bladder seems to have lost its expulsive force. When the catheter is inserted no urine flows except upon pressure over the bladder. The amount is small—twelve ounces in twenty-four hours. Its character is normal.

6th (seventh day). In the last four days his temperature has fluctuated between normal and 100°; the latter occurring at night. His general condition could not be more satisfactory; his appetite is good; his head feels perfectly clear; and he has had no pain. On the fourth day the wound was redressed and all the stitches removed. The wound was entirely healed. A little œdema exists in the centre of the flap, and pressure on it gives a sensation of resistance almost equal to that over the rest of the skull. Up to last night the catheter had to be used, excepting that he was able to pass his water when he took an enema; but since last night he has passed it voluntarily though very slowly and with little force. He has been up and dressed since the fifth day after the operation. He is anxious to go down stairs to his meals, but on account of the slight rise in his temperature I have not deemed it prudent. On June 3d he had two attacks characterized as before. On June 4th he had one more. The attacks are evidently becoming very much lighter and less frequent. Yesterday and the day before he had two aborted attacks. He, himself, is most annoyed by his left hand which is still paralyzed, though twice there have been slight involuntary movements in it. The elbow has entirely recovered from its slight paresis.

7th (eighth day). As his temperature had fallen to normal and he was anxious to go out, I allowed him to walk to a barber shop and get shaved. The left hand was still paralyzed.

The attacks after the second operation, as after the first, were increased in frequency, but they were not so severe, and they now diminished quite rapidly in severity, frequency, and duration, rarely exceeding one or two minutes in length. At present in an attack the left hand does not move, the eyes are staring, his right arm, legs and body stiffened, but little muscular movement; the mouth drawn to the right and the head turns to the left.

18th. Dr. W. J. Taylor reported his temperature as follows: In the right palm 37° C., the left hand 37.5° C., the right side of the head 37.7° C., and left side of head 37° C.

28th. I examined him carefully to-day, as he was to return home. His skull is perfectly firm, as much so on one side as the other, with very slight, if any, irregularity of surface where the pieces of bone were replaced. Pressure produces no yielding or pain. Except for the two scars one would not know that his skull had been opened. The fits have become greatly diminished, occurring now only once in two to four or five days, and then only of momentary character, practically *petit mal.* There is no convulsive movement whatever, and his mental condition is more satisfactory, inasmuch as he is more cheerful and communicative, and far less morose and despondent than when he first came under my care. His hand and wrist are still as before, but he has ceased to carry his arm in a sling as he did for the first three weeks after the operation.

I made the following measurements: Right biceps ten and one-eighth inches, left nine and three-quarters inches, right forearm two and one-half inches below the olecranon ten and one-quarter inches, and the left nine and three-quarters inches. Unfortunately I did not make any measurements of the same points before operation. Whether this difference is due to wasting or is simply a natural difference in his case of a smaller, because less used left arm I am unable to say.

Electrical responses of all muscles of the arm, forearm, and hand are equal and prompt on the two sides, both by faradic and by constant current. Unfortunately circumstances made it impossible for me to determine whether reactions of degeneration were present or not.

July 20. He writes that motion is beginning to return in the left hand.

Dr. George Dock examined the specimens of brain tissue and reports as follows. In all three cases reported in this paper, I may add, the specimens were placed in Müller's fluid the instant they were removed.

"The specimen was received in Müller's fluid on the day of the operation and examined in less than twenty hours after removal. It proved to be part of a convolution cut off at a right angle at one (lower?) end, at an angle of about 45 degrees to the surface at the other, and with a smooth base. It measured, when fresh, 32 millimetres in greatest length, 10 millimetres in thickness, and 18 millimetres in depth. The surface, from which the membranes had been removed, showed nothing unusual. In making a series of sections of an average thickness of 5 millimetres, a hemorrhagic spot, 3 millimetres in diameter, was found, in the lower third, just below the cortex. Examined fresh, in Müller's fluid, this showed: 1, blood corpuscles of normal color and outline; 2, multipolar cells, with no evident alternations; 3, nerve-fibres, with and without double contours, showing no swelling of the myelin and no apparent loss of it; 4, bloodvessels. The smallest of these showed numerous highly glistening spots in their walls, the larger ones no alteration in structure.

"Having been placed in the hardening fluid so promptly the specimen was soon ready for staining. It was stained by both ammonia-carmine and Weigert's method, the latter giving very satisfactory results. Minute extravasations of blood were found in all parts. Most of these are along the course of small vessels, some confined within the lymph-sheaths, others of irregular shape among the fibres of the white matter and in the cortex. There are no blood-pigment masses and no diffused staining. The large hemorrhage mentioned shows blood corpuscles with well-preserved nerve-fibres, free myelin in small globules and fine granular material. In sections from this part of the specimen there is marked dilatation of the perivascular lymph-spaces. Some of these attain a diameter of not quite one millimetre, being from two to three times as wide as their main vessels. The capillary in them is often distended and the mesh-work, plainly visible, encloses a few corpuscles; in rare cases, however, a large number. The vessels appear normal here as elsewhere. The nerve-fibres are intact, as a rule. In a very few places, in small areas, they do not appear. These areas are in the extreme outer layer just beneath the surface, and when found I have also found small hemorrhages beneath them. The main bundle of white matter shows no diminution in size or failure of reaction to stains. The cortical layer is unchanged, save for the hemorrhages. The ganglion-cells are present in all parts of this layer. Some of them are very pale, but none show atrophic or inflammatory changes. Many of them lie in spaces rather larger than normal, which may be due to an œdema of the space, or to the action of the hardening fluid."

REMARKS.—The first operation, in which the skull was not injured and the flap readhered to the skull and the wound healed without inflammation, teaches one important lesson—the marked lesion within the cranium that may follow a slight traumatism on the exterior. As I extended the bony opening at the second operation I wondered why, all at once, the dura became so adherent to the bone. In a moment I observed that this began just where I encroached on the area under the first flap. As injuries increase in severity their intracranial consequences must increase *pari passu*, so that we can easily understand how severe blows, even without fracture, may be followed by meningitis, or abscess, or, as in Case I., by a neoplasm.[1] Macewen (*Med. News*, Aug. 18, 1888) alludes to this and to the adhesion of the brain to the bone very happily as "anchoring the brain" and points out its deleterious results. I can hardly, however, concur in his inference that a higher temperature at the site of the injury is a contra-indication to surgical interference.

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[1] Cf. Horsley, AMER. JOURN. MED. SCI., April, 1887, p 365, Case VII.

The moment the brain was exposed the marked œdema was the one thing noticed. It extended over the entire area exposed. Over the convolutions the œdematous layer was about one-eighth of an inch thick, and over the sulci three-sixteenths of an inch or more, so that the sulci were at first very hazily seen. Whether this œdema was the essential lesion or not cannot be determined, but, though the brain was carefully examined by touch (in the sulci to the depth of one inch), no evidence of any tumor or other lesion that might cause the œdema was found. The examination of the excised brain by Dr. Dock shows that this œdema was not merely superficial, but extended into the brain tissue throughout all the excised part, and doubtless beyond, how far beyond we can only guess. Besides this, Dr. Dock found numerous hemorrhages, which he believes to be recent, and probably due to the necessary traumatism in separating this convolution from its neighbors and excising it. During the operation I noticed that the convolution back of it showed marked evidences of bruising, though, of course, the manipulation was as gentle as possible. Whether these hemorrhages would have occurred had the vessels been entirely healthy may be easily a question.

But the most interesting question is, as to the location of the centre. I sought for this in the post-Rolandic[1] convolution just below its middle. (Centres (*a*) (*b*) (*c*) in Ferrier's plates. See Gray's *Anatomy*, last Am. edition.) There were three convolutions exposed by trephining, and the line for the Rolandic fissure ran in the middle of the central one (Fig. 9, *b*). The fissures in front of, and behind convolution (*b*) were of equal depth, and another, also of equal depth, existed in front of convolution (*c*). On the whole, I am decidedly inclined to think that the sulcus in front of (*c*) was the precentral or vertical sulcus, the one between (*b*) and (*c*) the fissure of Rolando, and the one between (*a*) and (*b*) either the beginning of the intraparietal, or, possibly, a retrocentral sulcus. If I am right, the centre for the wrist and fingers which I removed was in the pre-Rolandic gyrus, its lower limit being at three-eighths of an inch above the temporal ridge, and its upper end where it fused with that for the elbow 32 mm. higher up, and the shoulder still higher, while the centre for the upper face was in the same gyrus immediately adjoining the excised portion at its lower end. If the reader will compare Horsley's figures for these centres (Gray's *Anatomy*, last Am. edition, and AMERICAN JOURNAL OF THE MEDICAL SCIENCES, April, 1887), he will be struck with the accuracy of their representation. None of the wrist and hand centre existed in convolution (*b*); whether any existed in the convolution in front of (*c*) or not was not tested by the battery, but in view of the complete palsy of the wrist and hand it seems improbable. As one of the few instances[1] in which the results of experiments upon animals have been verified on man it is most important and gratifying, giving us new confidence in this important method of research which has already done so much to make cerebral surgery not only possible, but successful and promises so much more in the future.

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[1] I have used the terms "pre- and post-Rolandic," instead of the more common names of these gyri, designedly. The fissure of Rolando is so important and well known that these names are instantly understood, far more so than "anterior central" or "ascending frontal," etc.

The higher temperature[2] on the right side of the head so long after operation together with the continuance of the fits, may not mean anything discouraging for the future, yet it is in such marked contrast to Case II. that I shall watch it with interest. Probably the œdema will subside slowly. Certainly to date (August 12th), though he has had occasional convulsive seizures and a number of attacks of *petit mal*, yet, on the whole, he shows considerable improvement both as to number and character of the fits, with a decided gain in mental status. By "compensation," it is nearly certain that in time he will regain control of the left hand through the other hand centre, a process already, in fact, beginning.

GENERAL REMARKS ON THE OPERATIVE TECHNIQUE.

My experience in these three cases, as well as assisting at several others, in the new field of cerebral surgery, warrants some general remarks which I trust may prove of value.

1. *Shaving the head.* So important do I regard this that I would consider no diagnosis as assured and no operation warranted that had not been preceded by shaving. The unexpected and unknown scars found have surprised me in other cases, as well as in those here related. Besides this, no reliable mapping on the head of the cerebral fissures and gyri can otherwise be made. These can also be now marked on the scalp by the aniline pencil.

2. *Antisepsis.* Practically, the admirable rules laid down by Horsley were followed, nor can they be too strongly insisted upon. (See details in Case I.) No spray was used during any of the operations, though it had been used all the morning in the room in the first case. It is also especially noteworthy that on the day before I operated on the third case, circumstances made it needful for me to operate on a case of cancer of the colon with a fecal fistula and profuse suppuration. Dr. Willliam J. Taylor assisted me in both operations; and our hands were, of course, saturated with infection. After the bowel case we carefully disinfected them with soap and water, alcohol and bichloride, and several times

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[1] Cf. Horsley's paper, l. c., pp. 358, 361, 362, and Macewen, Med. News, Aug. 18, 1888.

[2] The relative temperatures of the two sides of the head before the operation have been unfortunately mislaid.

repeated this during that afternoon and the next morning. No infection followed in the brain case—a most valuable lesson as to antisepsis.

3. *Anæsthesia.* In all three cases ether, and not chloroform, was used, and I saw no reason for any preference for chloroform.

4. *Marking the bone.* Whether to mark the site of a scar or other lesion, or to fix the site of the Rolandic or other fissure of the brain, the nicking of the bone by a gouge, through one or more small incisions in the scalp, is a most useful preliminary to the horseshoe-shaped incision for the flap. As soon as this flap is raised, all landmarks are lost, and one can only "orient" himself by a reapplication of measuring instruments, which probably have to be disinfected, or perhaps cannot be. Moreover, in my first case, it enabled me, as related, to fix accurately the situation of the tumor.

5. *Access to the brain.* The large horseshoe-shaped flap of scalp is infinitely preferable to the old crucial incision. The large trephines now used (one and a half, two, and even two and a half inches) are also a great help, and I think it a rule, almost without exception, that the bony opening should be ample. Bergmann's opposition to operative interference with large cerebral tumors, on account of the probable consecutive œdema, from want of support by the skull, certainly cannot hold good. In my third case the preëxisting œdema will perhaps find its best relief, indeed, from the operation. The success that has practically followed such operative procedures is its best vindication. Plenty of room, both for observation and for work, should be had. A small opening may defeat the very object for which we operate. A large opening adds no additional danger to the brain, and even if as large as in Case III., the integrity of the skull may be *entirely* restored. The "surgical engine" may be very useful in rapidly increasing the size of the opening, but it should be used by an expert (a dentist if the surgeon himself is not accustomed to its use) lest accidental injury be done to the brain. The chisel is not only needless but dangerous. It is quite surprising, also, how far beyond the limits of the skull opening we can feel and even see. The brain allows of gentle pressure very readily, and the finger can be inserted an inch all around the opening. The incision in the dura should also follow the margin of the bony opening (one-quarter of an inch away) and not be crucial. It may then be replaced and secured by catgut with ease. I have had some trouble in doing this with the ordinary needles, and have had made a handled needle with a sharp, short curve and an eye in the point. Probably a sharply curved staphylorrhaphy needle would answer well.

6. *Hemorrhage.* For the scalp I used the narrow band of the Esmarch apparatus in the second and third cases, as suggested by Dr. M. Allen Starr. In the second it answered admirably, but in the third

was soon cast aside as unnecessary. Generally, I believe, it will be very useful.

Hemorrhage from the vessels of the brain itself is one of the most important of all the operative questions. Morphia, as a preliminary, is useful, I have no doubt, as is also ergot, though I should give the latter in a dose of fʒij–iv rather than ʒj, as I used. The effect of the cocaine applied directly to the brain was certainly very good. I shall, however, try it in a stronger solution (ten per cent.) in the next case. Very possibly, also, antipyrin might be of use in the same way. All such solutions, corks, bottles, etc., should be sterilized. I also used boiling water cooled to 115° or 120° F., to check the hemorrhage, and I could not see that its liberal use did any harm to the brain tissue. Pressure, also, is a most valuable means. But, after all, the chief reliance must be on the ligatures of catgut. They should not be chromicised, as that lasts too long, and may be an irritant, but are best prepared in oil of juniper and kept in alcohol (Kocher). In my second case I had no difficulty in tying the vessels, but in the third, and especially the first, their friability was such that the most delicate manipulation and equal tension on the two ends were requisite for success. It is not the arteries but the large thin-walled veins that give trouble. The cautery in any form should never be used. If there be any trouble in securing vessels of the dura or brain near the edge of the bony opening, this opening must be fearlessly enlarged, so as to give ready access to them. If the middle meningeal (or other artery, of the dura) cannot easily be tied at the cut edge, or even in its continuity, a suture may be passed around it by a needle passed through the dura, but the dura should then be carefully lifted so as to avoid any underlying veins. Weir has suggested the application of clamps to the cerebral vessels for twenty-four hours. My experience would make me doubt whether they would hold with such friable tissues, and, if they did, the tossing about of the patient's head might easily displace them, and possibly even involve great danger to the brain itself.

7. *Recognizing the centre sought for.* Only in Case III. did I have a definite centre in view. Ordinarily the gyri and sulci of the surface would be a fairly reliable guide, together with the various methods now used for mapping these out on the surface of the skull. If in doubt, the ordinary faradic battery will serve us excellently, as was shown in this case. The response to the stimulation of various parts of the same convolution was immediate, undoubted, and in every way satisfactory.[1] In order more handily to use this means of diagnosis I have had made by Mr. Flemming this little rubber handle with two insulated poles, the

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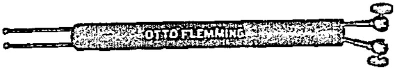
[1] Cf. Horsley's Case V., The American Journal of the Medical Sciences, April, 1887, p. 358

stems of which, being flexible, can be placed near together or far apart as desired.

8. *Photography of the brain.* This can readily be done by an ordinarily expert amateur. Dr. Lewis and I are both of the opinion that the exposure should be practically instantaneous with the most sensitive plates made. Even with such plates they may be under-exposed on a cloudy day. But the danger of movement by the patient and the constant oozing of the blood make it desirable to have the shortest possible exposure. Possibly the "flash powder" may be useful, but if employed the possible firing of the ether should be borne in mind. The photography is scarcely any interruption to the operation in the hands of a competent assistant. But I was disappointed in its results in both my cases (II. and III.). It gave no good details owing chiefly, I think, to the wet, glistening, curved surfaces and deep shadow at the point of excision. I would prefer to have a rapid sketch made by a good artist who understands anatomy.

FIG. 10.



9. *Drainage.* Combined tubular and capillary drainage answered best in the brain, as elsewhere. The tubing should be removed, as a rule, at the end of twenty-four hours. Whether it would have been wise to do so in my first case, with evidences of increasing pressure, is even now, in my mind, doubtful. The horsehair may be removed in three to five days. Everything should bend to the speediest possible healing of the wound, thus preventing hernia cerebri and favoring a quick recovery.

10. *Replacement of the bone.* This most interesting and valuable recent addition to our operative procedure receives further encouragement from the results of Cases II. and III. In the last the disk of bone (one and a half inches) was replaced with about fifteen fragments bitten out by the rongeur forceps. The skull is so completely restored that except for the scars and slight flattening one would not know that it had ever been trephined. Heretofore, when the dura mater has been removed, the bone has not been replaced, but Case II. shows that even then it may be done with ease by attaching it to the under surface of the flap by chromic catgut. Of course, the small pieces cannot be so utilized, so in Case III. I had a lamb in the adjoining room, and if the removal of the dura had been necessary and any large gap been made by the rongeur forceps I meant to replace the trephine button and fill up the remaining gap by another button from the lamb's skull, trimmed

by the rongeur to suit the opening. I find that the back of the lamb's skull has nearly the same curve and thickness as man's, and will give one good button from its centre or, at a pinch, two might be got from it.

I had no trouble with the large disks, and do not think it at all needful to chop them up into small fragments as Macewen did. But if the bone is to be replaced, the most minute care must be given to it from the moment of its removal to that of its replacement by one of the assistants, whose sole care it should be. I have recently had to remove a similar one and one-half inch button from a case trephined by a friend. By accident the button escaped observation for perhaps twenty minutes or more after its removal, and so lost its heat, even if it did not become septic, which seems not probable. It gave no trouble for over two months, but then produced an abscess, headache, etc., which were quickly relieved by its removal. It was entirely necrosed. It is, however, proper to say that the skull was unusually thick and almost all compact tissue, and that, soon after the primary operation, the wound had to be reöpened for hemorrhage from the scalp. Even with the utmost care, disks of bone, if chiefly of compact tissue, cannot always be successfully replaced. I recently had to remove three such, much smaller (one-half inch) buttons from one of my cases of trephining of the lower jaw. Yet Dr. J. S. Miller (*Medical News*, liii. 136) has just reported a successful case of reimplantation of one such button in the same bone.

11. *Rapidity of recovery.* Case I., in consequence of the reöpening of the wound and later complications, was long in getting well; but Cases II. and III. were out on the street on the seventh and eighth days, their highest temperatures having been 99.8° and 100° respectively; Case III. with but little, and Case II. with absolutely no pain and no medicine. No iodoform was used. I get better results without it and its abominable odor.

Thanks chiefly to vivisection and antisepsis, cerebral surgery will show, within the next few years, triumphs as exact, extraordinary, and beneficent as has abdominal surgery.

1729 Chestnut Street, August 27, 1888.

CÆSAREAN SECTION WITH OÖPHORECTOMY.

REPORT OF A SUCCESSFUL CASE.

By John G. Jay, M.D.,
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Since the earliest history of gastro-hysterotomy this operation has occupied a position of preëminent interest in obstetrical surgery. It was probably first brought to notice at a very early date, and may have had